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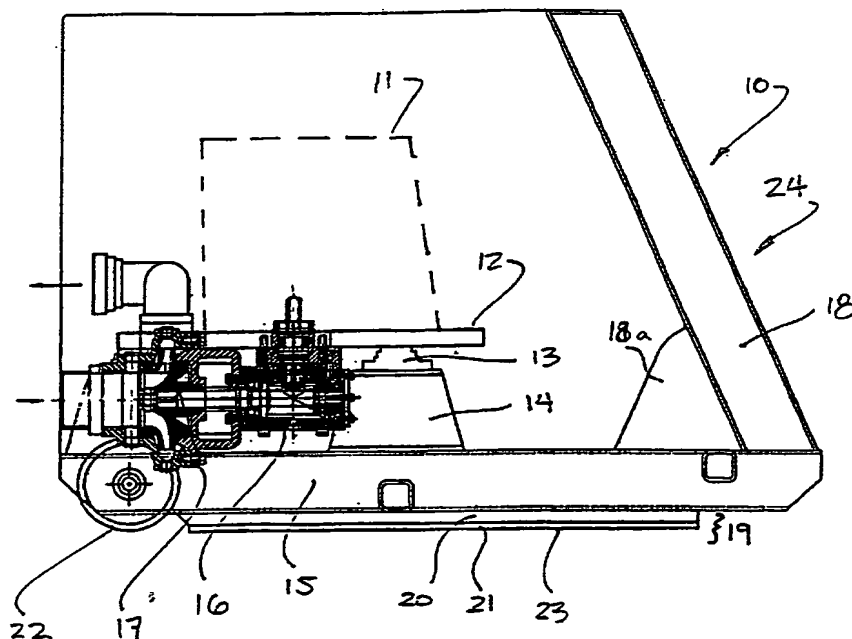
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(54) Title: ENGINE COUPLED PUMP WITH 90 DEGREE GEARBOX



(57) Abstract: A light, powerful and manoeuvrable centrifugal pump unit suitable for fighting fires, emptying flooded compartments and providing auxiliary cooling water on board ships includes a frame (10) which supports a mounting plate (12) through vibration isolating mounts (13). A marine grade water-cooled diesel engine (11) mounted above the plate (12) so that the axis of rotation is vertical. A 90 degree gear box (16) driven by the engine (11) is mounted below the plate (12) and drives the pump (17) of which the axis of rotation is horizontal. Also suitable for fighting fires in rural and remote environments.

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## **FIRE, SALVAGE AND COOLING PUMP**

### **TECHNICAL FIELD**

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The invention pertains to pumps and more particularly to a compact, self-powered pump for marine environments.

### **BACKGROUND ART**

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A fire on board a ship, particularly a ship at sea, is a serious threat to life and property. Because an onboard fire is capable of disrupting the ship's firefighting, pumping, cooling and electrical systems, there exists a need for a self-powered pump which is adapted to draw water from the sea, sometimes from about 7 metres below, to put out the fire. The requirement also exists for such pumps which are portable in the sense that they may be moved by manpower from place to place aboard the ship. Accordingly, such pumps must be compact and light-weight. Such pumps may be powered by petrol engines but diesel is the preferred fuel for safety reasons. Previous attempts to provide diesel powered pumps which comply with various maritime and naval regulations have been largely unsuccessful. Diesel motors are generally bulky and heavy. Accordingly, these various requirements for power, compactness, weight, reliability in marine environments and versatility have provided the motivation for the present invention.

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It is noted that the type of pump provided by the present invention is equally adaptable to  
25 fighting fires on board ships, pumping water from flooded compartments aboard ships,  
providing auxiliary cooling water to a ship's equipment and fighting fires in remote and  
rural environments for example by pumping water from residential swimming pools or  
other water sources as required and without the need for external power.

### 30 SUMMARY DISCLOSURE OF THE INVENTION

Accordingly, there is provided a self powered pump comprising a frame which supports a  
mounting plate. Vibration isolating mounts separate the plate from the frame. A marine  
grade, water cooled diesel engine is mounted above the plate so that its primary axis of  
35 rotation is vertical. A 90 degree gear box is mounted below the plate and is driven by the  
diesel motor. An output shaft of the 90 degree gear box drives a centrifugal water pump  
whose axis of rotation is horizontal.

### BRIEF DESCRIPTION OF THE DRAWING FIGURES

40 In order that the invention may be better understood, reference is now made to the  
accompanying drawings in which:

Figure 1 is a side elevation, partially cross-sectioned illustrating a self contained pump  
45 according to the teachings of the present invention;

Figure 2 is a top plan view of the frame of the device depicted in figure 1;

Figure 3 is a front elevation of the frame and vibration mounted instrument panel of the  
50 device depicted in figure 1;

Figure 4 is a perspective view of the device depicted in figure 1;

Figure 5 is a top plan view of the mounting plate depicted in figure 4;  
55

Figure 6 is a perspective view of the underside of the plate depicted in figure 5;

Figure 7 is a perspective view of the removable oil sump;

60 Figure 8 is a cross sectional view of the 90 degree gear box and centrifugal pump of the  
present invention.

#### **BEST MODE AND OTHER EMBODIMENTS OF THE PRESENT INVENTION**

65 As shown in figure 1, a portable and self-contained pump for marine and other  
environments comprises a rigid aluminium frame 10 which supports a water cooled thirty  
horse power, marine grade, diesel engine 11. The diesel engine 11 is affixed to a  
mounting plate 12 which is supported by vibration isolating mounts 13 above risers 14  
which are affixed to the lower side rails 15 of the frame 10.

70

An "L" drive or 90 degree gear box is mounted to the plate 12 and below it. The gear box 16 is driven by the diesel motor 11 and in turn drives a centrifugal pump 17.

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In preferred embodiments, the diesel motor 11 is a YANMAR model P36 and the pump 17 is a Waterous™ model CP2.

As shown in figure 2, the aluminium chassis or frame 10 comprises parallel horizontal side rails 15 and rearwardly inclined uprights 18 which are attached to the side rails 15 and reinforced with gussets 18a.

80

Beneath each of the side rails 15 there is mounted an elongated stabilizing rail 19 which can optionally have vibration isolating features. Each of the two rails 19 (as shown in figures 1 and 3) consist of an upper Teflon® element 20 and an optional lower rubber element 21. In operation, the unit bears its entire weight on the pair of Teflon and rubber  
85 assemblies 19, which are particularly adapted to absorb vibrations which may originate from underwater explosions as well as stabilizing the position of the unit during operation.

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As shown in figures 1 and 2, the horizontal side rails 15 also support, toward their back end, and behind the assemblies 19, a pair of wheels 22. The lower most point of each wheel 22 is above the bottom surface 23 of the assembly 19 so that when at rest, the wheels 22 do not touch the ground. However, upon elevating the front 24 of the unit, the

wheels 22 make contact with the deck or ground so that the unit may be wheeled by a single individual. In preferred embodiments, the wheels are mounted between or in-  
95 board of the side rails 15 as show in figure 2.

As shown in figure 3, the rearward sloping uprights 18 support between them, a vibration isolated instrument panel 30. The vibration isolation of the panel 30 further protects the instruments 31 from vibration stemming from the motor 11 or external vibrations. One or  
100 more openings 32 in the front surface of the unit below the instrument panel 30 provide access to the motor and other components contained within the frame. It will be appreciated that the unit may be provided with an outer casing or exterior cover panels, as required.

105 As shown in figure 4, it can be seen that the motor 11 is further stabilised by a pair of arms 41 which extend from the inclined uprights 18 to engine mounting bolts 42. It can also be seen that the mounting plate 12 includes a rear facing cut out portion 43 located between the rear mounting holes 44 which cut out portion serves to compactly accommodate the casing of the centrifugal pump 17. The motor also is provided with a  
110 mounting bracket 45 which is located below the fly wheel 46 the mounting bracket 45 is adapted to retain a hand wound, spring powered starter motor which is adapted to engage the ring gear and provide enough power to start the engine when manual starting is required.

115 As shown in figure 5 the integral mounting plate 12 is fabricated from marine grade  
aluminium. It includes rearward mounting holes 44 and forward mounting holes 47 each  
of which is adapted to allow the plate to be coupled to vibration isolating mounts 13. The  
upper surface of the plate 12 includes a central portion of increased thickness 48. This  
portion 48 contains the holes which are required to mount the motor 11 as well as the  
120 required openings for the drive shaft, exhaust water and oil fittings which the motor  
requires. As shown in figure 5, the area of enlarged thickness 48 includes an "L" shaped  
grove or channel which serves as a gallery for collecting engine oil to accumulate.  
Because the plate 12 is fabricated from aluminium and because it is somewhat thicker  
than it need be for purely structural reasons, it acts as a heat sink and radiator for the  
125 engine and enhances the ability of the unit to remain at the correct temperature during  
emergency or firefighting operations. Cooling is further accomplished by tapping the  
output 49 of the pump 17 thus allowing a fraction of the pump's output to be directed into  
the cooling jacket of the motor 11.

130 As shown in figure 6, the underside of the plate 12 is provided with cooling water input  
and output nipples 50 which are threaded or set into oversized openings and are therefore  
able to accommodate the unusually high pressure (150 psi rather than 50 psi) delivered by  
the output of the centrifugal pump 17. Internally of the motor, the thermostat galleries are  
enlarged as well. The underside of the plate 12 is provided with a down pipe 51 for  
135 drawing lubricating oil from the sump. The underside of the plate 12 also supports an  
exhaust pipe 52 and includes an opening 53 for the drive shaft.



As shown in figure 7, an "L" shaped oil sump 70 is provided. The upper surface 71 of the sump includes access holes 72 for admitting engine oil and discharging sump oil as well as mounting holes for receiving fasteners 73 which extend through the mounting plate 12. The shape of the sump 71 provides additional surface area for cooling, volume and ease of removal and compactness as it is able to fit around the exhaust.

As shown in figure 8, the "L" drive or 90 degree gear box 16 includes a main casing 80 which supports a portion of the shaft 81 which extends between the gear box 16 and the centrifugal pump 17. The "L" drive is of the step-up type, taking the output of the motor at about 4300 rpm and delivering a 6000 rpm output to the pump. One end of the shaft 81 supports a spiral bevel gear 82 which is driven by a corresponding spiral bevel drive gear 83 which is carried by the shaft 84 that extends between the motor 11 and the gear box 16. The gear box end of the shaft 81, via the hub of the spiral bevel gear 82, is also supported by a tapered roller bearing 85. The main housing 80 has affixed to it a mounting plate 86 which includes a well 87 for receiving a vertical thrust bearing 88. The well 87 also retains a radial thrust bearing 89. The axial thrust bearing 88 supports a thrust collar 90 which is integral with the shaft 84. The well 87 also includes an upper extremity 91 which may support seals between the motor and gear box as required. The main case 80 of the gear box 16 also includes an oil outlet opening (not shown) which is located closely adjacent to the area where the spiral bevel gears 82, 83 mesh. The rotation of the bevel gears creates a spray or supply of oil which enters the outlet opening and which may then be delivered to areas of the gear box which require lubrication, namely the thrust bearings which support the shaft 84.

In some embodiments of the invention, used cooling water is injected into the engine's exhaust gases. This creates a cooled exhaust stream which is particularly useful during use of the pump in hot environments such as below the deck of a ship.

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While the present invention has been disclosed within relation to particular examples of details and construction, these should not be construed as limitations to the scope or spirit of the invention.

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What is claimed is:

1. A self powered pump comprising:

a frame which supports a mounting plate;

5 a marine grade, water cooled diesel engine that is mounted above the plate and having a vertical axis of rotation;

a 90 degree gear box being mounted below the plate that is driven by the diesel motor;

an output shaft of the 90 degree gear box driving a centrifugal water pump whose axis of rotation is horizontal.

10

2. The pump of claim 1, wherein:

the frame comprises a pair of side rails located below the mounting plate and inclined uprights which are attached to the side rails, the uprights supporting an instrument panel;

the side rails supporting a pair of wheels.

15

3. The pump of claim 1, wherein:

the frame comprises a pair of side rails located below the mounting plate and inclined uprights which are attached to the side rails, the uprights supporting an instrument panel;

the side rails having mounted on a lower surface of each a stabilising rail.

20

4. The pump of claim 1, wherein:

the mounting plate further comprises a rear facing cut-out portion for accommodating the water pump.

5. The pump of claim 1, wherein:

the mounting plate is aluminium and has formed in it a hole for receiving a drive shaft of the motor; and

the mounting plate having mounted to an under-surface, an oil sump.

5

6. The pump of claim 5, wherein:

the sump is L shaped.

7. The pump of claim 1, wherein:

10 the gear box is a step-up type.

8. The pump of claim 7, wherein:

the gear box and pump share a common shaft which passes between them.

15 9. The pump of claim 7, wherein:

a common shaft passes between the pump and gear box;

one end of the shaft having mounted on it a first spiral bevel gear having a hub,

the gear box supporting the hub in a bearing.

20 10. The pump of claim 9, wherein:

an input shaft of the gear box carries another spiral bevel gear which meshes with the first spiral bevel gear, the rotation of the bevel gears creating an oil spray which enters an outlet opening and which is delivered from that opening to other parts of the gear box.

11. The pump of claim 1, wherein:

a portion of an output of the pump is diverted to the cooling jacket of the motor.

5 12. The pump of claim 7, wherein:

a gear box end of the shaft is also supported by a tapered roller bearing;

a main housing of the gearbox having affixed to it a mounting plate which includes a well  
for receiving a vertical thrust bearing.

10 13. The pump of claim 12, wherein:

the well also retains a radial thrust bearing.

14. The pump of claim 12, wherein:

the thrust bearing supports a thrust collar which is integral with the shaft.

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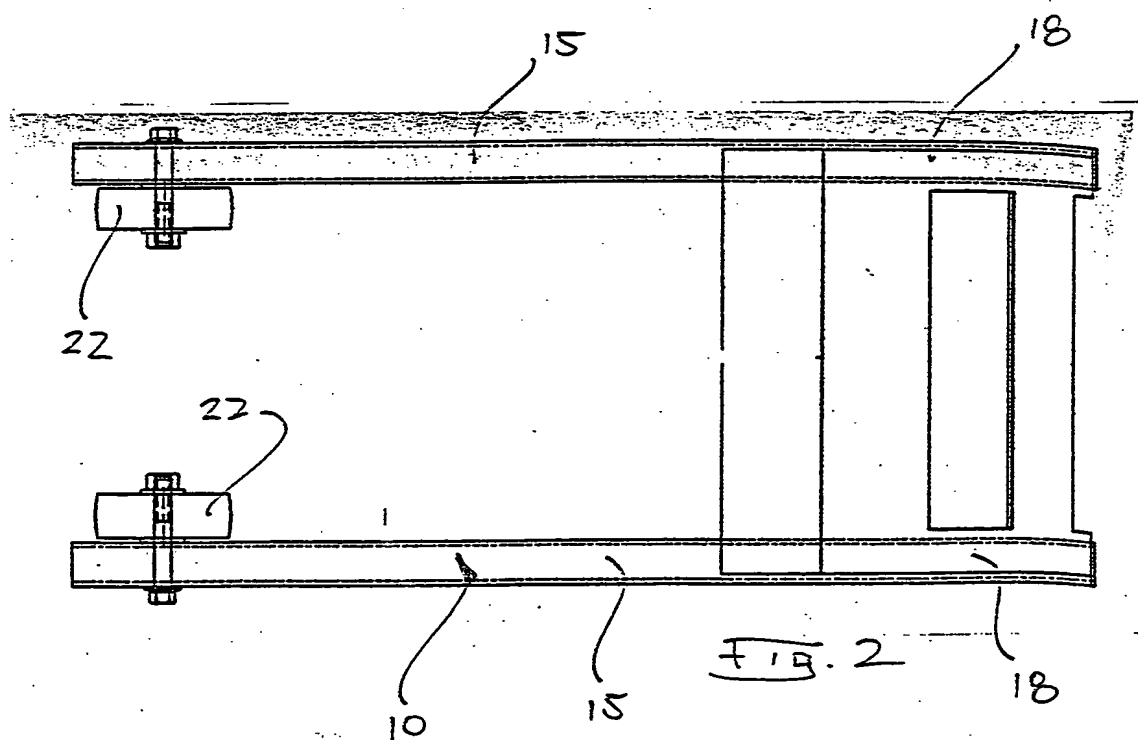
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### ABSTRACT

A self powered pump has a frame which supports a mounting plate. Vibration isolating mounts separate the plate from the frame. A marine grade, water cooled diesel engine is mounted above the plate so that its primary axis of rotation is vertical. A 90 degree gear box is mounted below the plate and is driven by the diesel motor. An output shaft of the 90 degree gear box drives a centrifugal water pump whose axis of rotation is horizontal. The resulting pump is light, powerful and maneuverable, thus adaptable to fighting fires on board ships, pumping water from flooded compartments aboard ships, providing auxiliary cooling water to a ship's equipment and fighting fires in remote and rural environments for example by pumping water from residential swimming pools or other water sources as required and without the need for external power.



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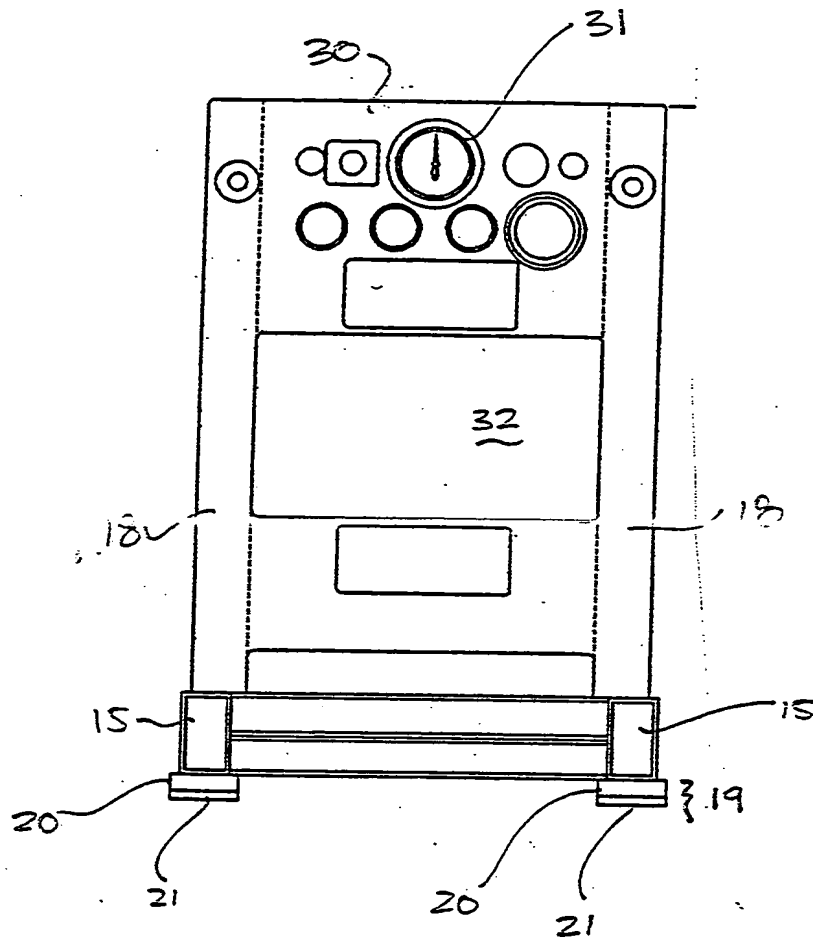


Fig. 3



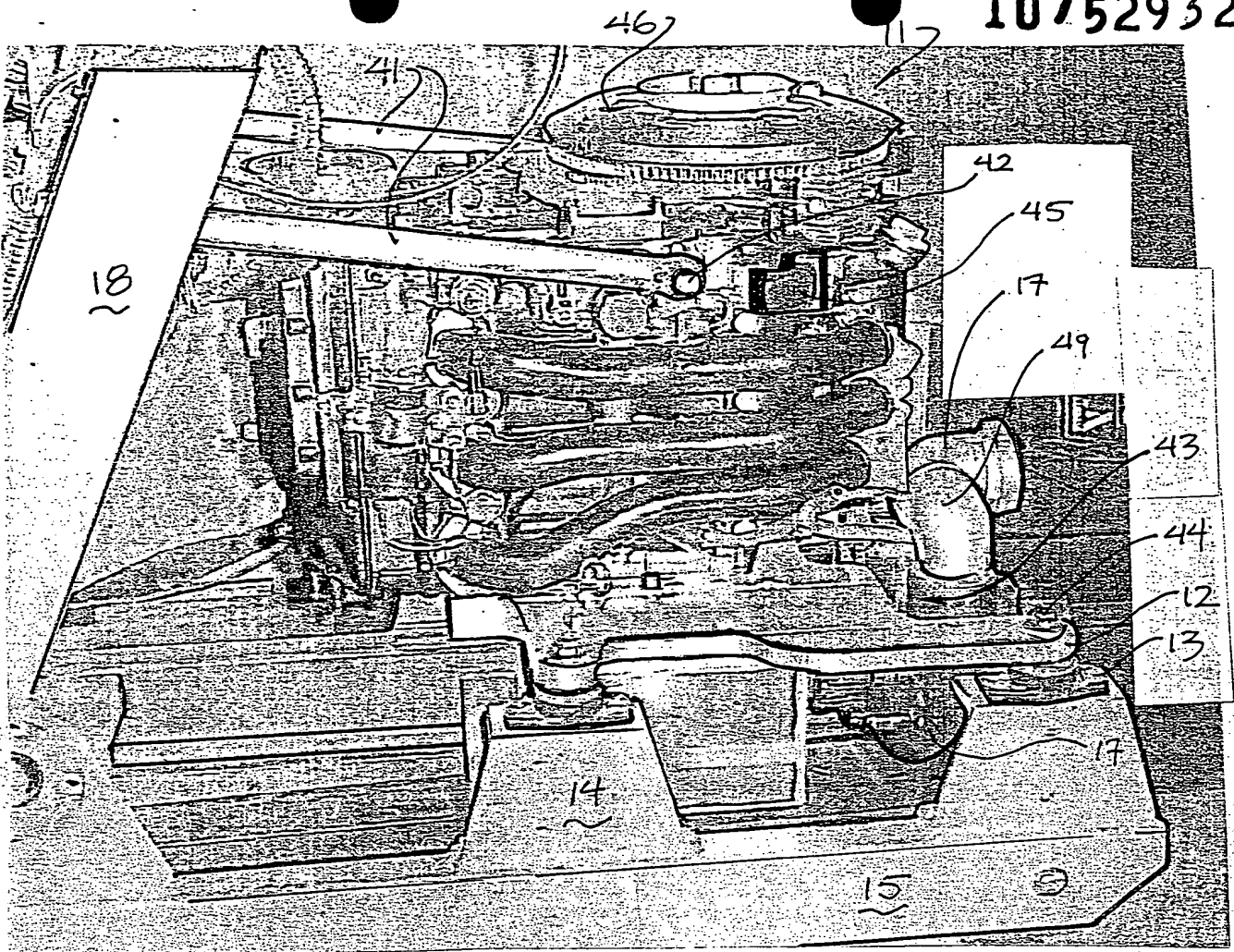


Fig. 4

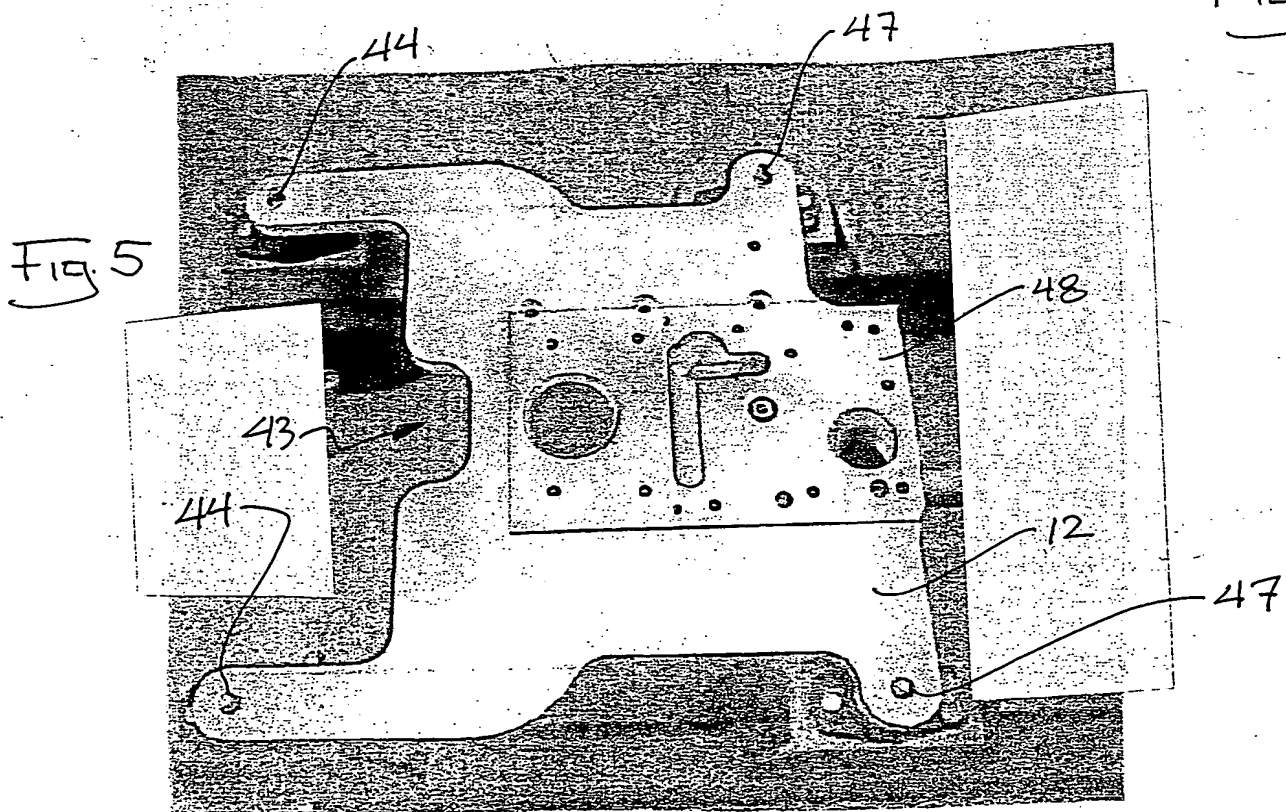


Fig. 5

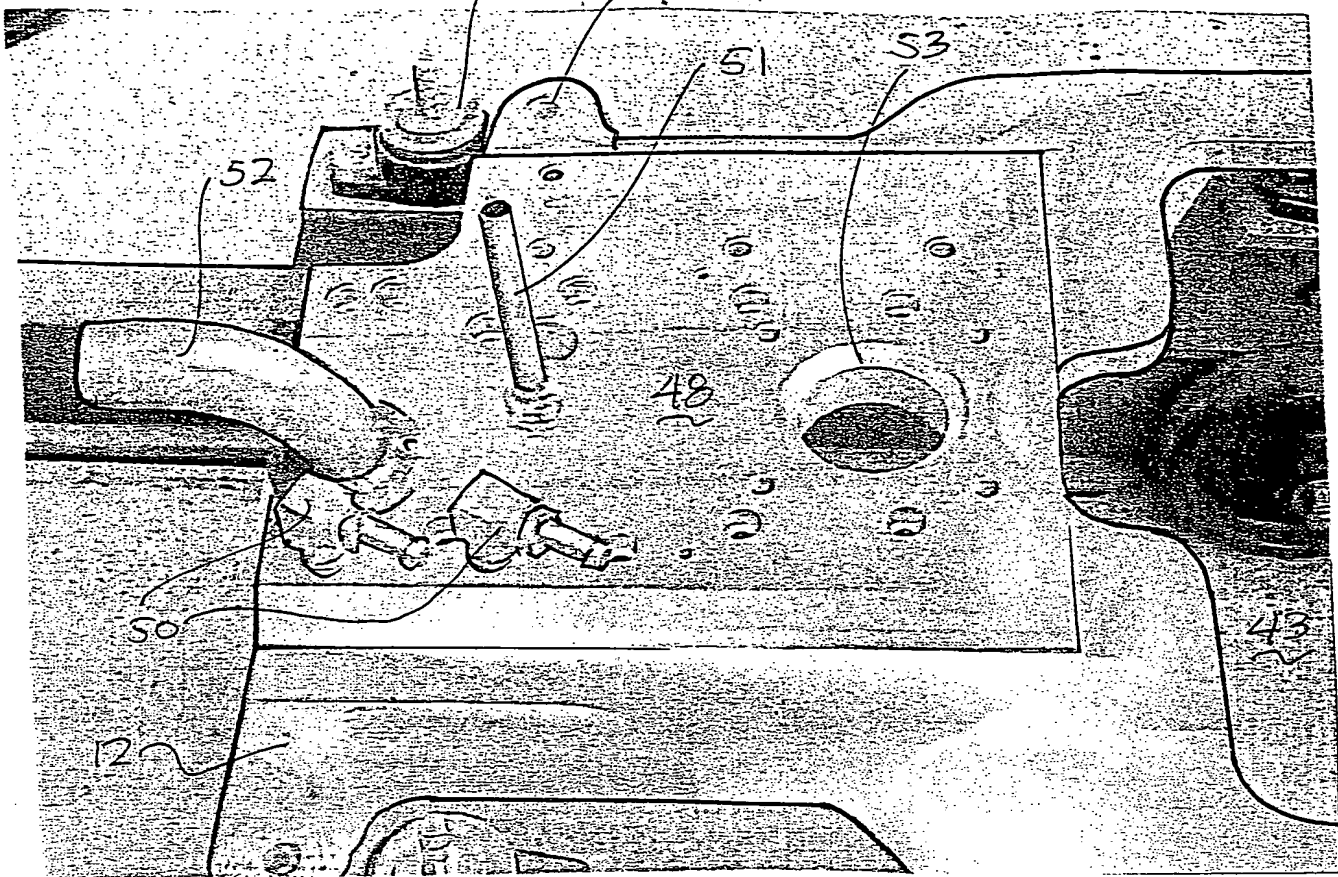


Fig. 6

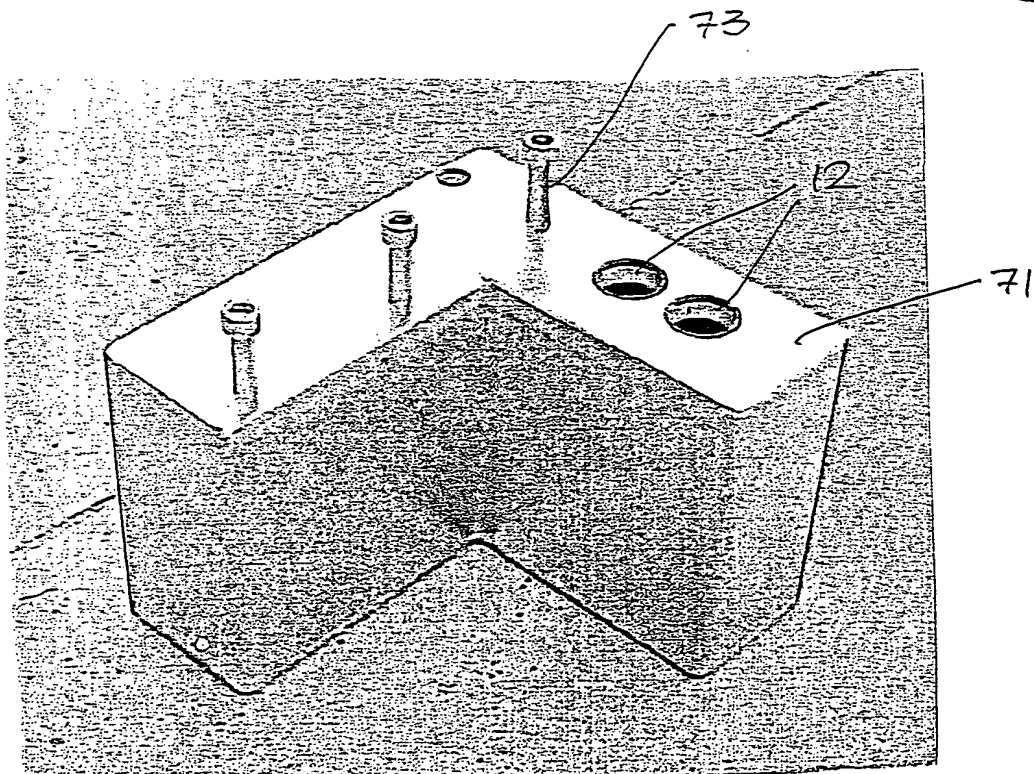
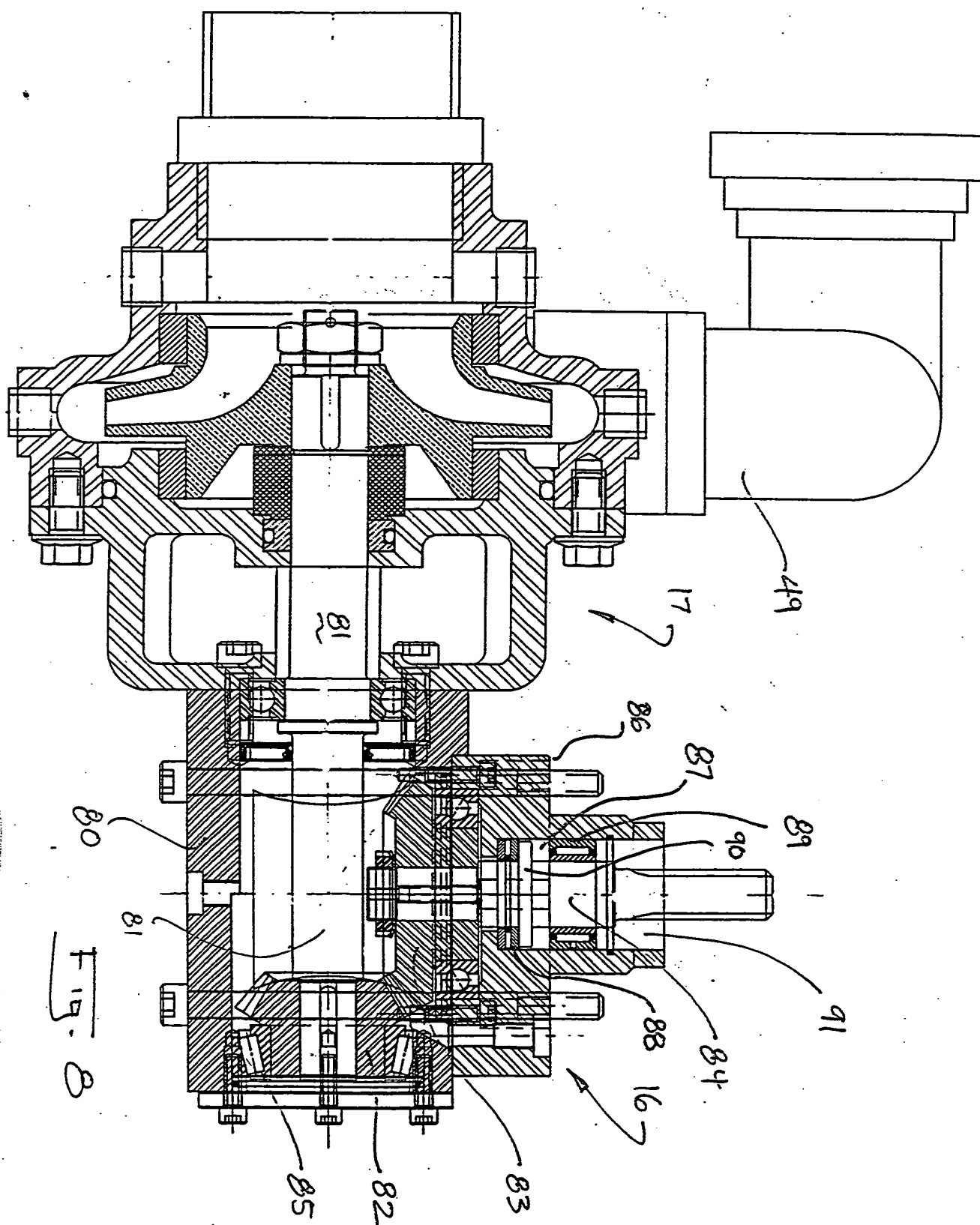


Fig. 7

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU03/01294

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. 7: F04D 13/02, 29/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See below under "Electronic database consulted"

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI : keywords : pump, gear, engine, 90 degrees, shaft and similar terms

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 92-103577/13, Class Q56, SU 1645635A (GRIBOV) 30 April 1991 Abstract and the figure	1-14
X	US 6419472B2 (KOBENSEN) 16 July 2002 The whole document	1-14
X	KARASSIK et al. (Ed.), "Pump Handbook", 1976, McGraw-Hill Book Company See pp. 6-124 to 6-127, figures 1 and 4	1-14



Further documents are listed in the continuation of Box C



See patent family annex

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Date of the actual completion of the international search

24 November 2003

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU03/01294

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
US	6419472	CA 2339427	DE 10011187
		US 2001021351	EP 1132620
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